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Is Enterprise Architecture in Web-reliant Portuguese SMEs in line with academic best practices?

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Abstract

This paper aims to study the current Enterprise Architecture Standards in Web-Reliant Portuguese SMEs. This is done to fill the gap observable in Enterprise Architecture literature in smaller companies. As such, several Models were created, using the Archimate Methodology and further evaluated by four companies. It was discovered that Small Businesses outsource a large number of their non-core activities and that they lack experience with regards to more exceptional processes. It was concluded that Small Businesses in Portugal possess a level of Enterprise Architecture comparable to academic best practices.

Keywords: Enterprise Architecture; Archimate; Web-Reliant Portuguese SMEs; Small Business

Introduction

The purpose of this thesis is to address the issue of lack of literature regarding Enterprise Architecture for Web-Reliant Portuguese SMEs and therefore generate theoretical and academic value.

As it has been proven already, Enterprise Architecture (from now on referred to as EA) carries a great deal of advantages and benefits for any company that takes the time and resources to properly invest in it and research it (Bernaert, 2015). However, this is most often something that is only done by large enterprises (Bernaert, 2015) (Gomes, 2013) Due to the lack of both monetary and human resources, as well as the lack of time needed in order to plan for strategy and future investments, smaller companies often find themselves devoid of any formal architecture (Bernaert, 2015).

This thesis aims to test whether or not this is the reality for Web-reliant Portguese SMEs, making use of the research question: "**Is Enterprise Architecture in Web-reliant Portuguese SMEs in line with academic best practices?**".

By evaluating the EA of these companies based on these best practices, the degree of fit with these will be evaluated and these tacit notions belonging to companies will be documented in structured but generalized EA models that can be applied to companies of a similar scale, in various markets.

This work will be structure in the following fashion: it will begin with a review of the relevant **Literature**, followed by the a detailed description of the approach taken to develop the work, followed by a **Description of the Companies** that cooperated with it and the **Metamodel** used to develop the best-practice based Models, a list of the created **Models** and **Viewpoints**, followed by a description of the **Feedback** given by the companies and the constraints of this work and finally, the **Conclusions** taken and ideas for **Future Work** based on this work.

Research Question

The purpose of this work is to determine whether or not EA in web-reliant Portuguese SMEs can be considered to be up to academic standards and best practices.

In order for companies to be considered up to standard, it is required that their operational realities, meaning, how they organize themselves and their Business Processes, be similar enough to the researched best practices for EA, adapted to the size of their organizations. If this is not the case, for over half of the models created based on said best practices, then one cannot say that Portuguese SMEs manage to reach these standards.

Literature Review

The most relevant source of literature for this work and arguably the most comprehensive collection of material on EA is the book "Enterprise Architecture at Work", written by Marc Lankhorst. It provides the necessary basic definitions of EA and its uses real life examples of its applications. Under the definition given, EA is "a coherent whole of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure."

More importantly, it explains the history of EA and the different languages and methodologies that exist for it. The most relevant of which are the Archimate methodology and the Service Oriented Architecture (often called SOA).

To take the explanation of what SOA is and its value in EA: "SOA represents a set of design principles that enable units of functionality to be provided and consumed as services… Services provide the 'units of business' that represent value propositions within a value chain or within business processes… In the service economy, enterprises no longer convert raw materials into finished goods, but they deliver services to their customers by combining and adding value to bought-in services. As a consequence, management and marketing literature is increasingly focusing on service design, service management, and service innovation".

The Archimate methodology was created in 2004 by the Open Group and is one of the most widely used in EA, greatly focusing on the practical usage of SOA. It aims to treat each process as a service that is used by services at higher layers of the architecture, even if these higher layers belong to the same business unit or directly above service in the architecture. The language is also simplistic and general enough in the concepts it uses, so as to model many of the aspects within specific domains.

Finally, one other important piece of information regarding EA and the usage of Archimate are "Views" and "Viewpoints".

Borrowing the definition given for the former: "a representation of a system from the perspective of a related set of concerns". To better clarify, views in Archimate are divided into "Business View", "Application View" and "Infrastructure View". The first is used to represent business processes, actions taken during those processes, who takes those actions, which areas of the business they belong to, which information they use to take them, which interfaces and means of communication between business areas and individuals exist and finally, what these processes ultimately produce. The second represents the software and communication networks that are present in the execution of said processes, as well as the existing data required and the software repositories for said data, as well as the automatically regenerated services that come to be used by other parts of the software. The third and final view focuses on the machinery and hardware belonging to the company, as well as the software, but instead of focusing on the processes that it executes, it focuses on clearly identifying the software itself.

Viewpoints are representations that allow readers to view a greater number of processes and departments at the same time, often in exchanging for sacrificing detail. Each viewpoint is aimed at showing information to a specific stakeholder, each with their needs in terms of detail shown and business area of relevance.

Regarding the articles and scientific journals that were researched, it is worth noting the general inadequacy and unavailability of information regarding the topic of this thesis. This comes mainly in two forms: the fact that most journals, thesis and reports that can be found when one searches for EA mainly explore IT related projects and IT architecture projects, but not architecture in regards to businesses and business processes and the fact that most EA materials that do delve into

companies and businesses do so only for large companies. This is a fact that is always mentioned in the few theses that address the EA of smaller companies.

There were, however, three theses that can be seen as steps in the right direction, in regards to EA modeling and its supports of SMEs.

In 2013, a thesis with the title "Methodology for Building and Maintaining Enterprise Architectures in Small and Medium Enterprises" was developed by Ruben Gomes, which had a similar goal to the one this thesis has. It aimed to help develop a model to assist companies, through the usage of the Enterprise Architecture Planning and the Zachman framework. With its development, derived from the outset, from meetings with company representatives, it focused exclusively on one Portuguese retail SME, which was mostly based around logistics and the departments for which the model was developed was exclusively the sourcing department. The model created also focused exclusively on the business processes and did not give focus to the software part required for the same to function.

Published in 2015, Maxime Bernaert's PhD thesis, titled "Enterprise architecture for small and medium-sized enterprises:CHOOSE", focused on the development of the CHOOSE methodology, which was a brand new EA perspective, language and software that was developed from scratch to address the needs of SMEs, reducing needless complexity and options, as well as the steps required to implement it. It was developed through an action research programme with four distinct SMEs and two other large enterprises.

The 2015 Master's thesis "Construção de Sistemas Integrados de Gestão para Micro e Pequenas Empresas" by Pedro Crespo outlined the Macro Architecture of a "Software as a Service" platform that could provide several types of internal support services to SMEs and allow for the ability to

conduct commercial trade in between companies. Its aim was to provide a solution to the inefficiencies in IT in SMEs derived from outsourcing the IT portion of the business, resulting in the company being sold a bundle of software programs that were often not tailored to the specific needs of the company or the way they handled their operations.

Finally, it is worth mentioning what exactly SMEs are and what defines them. According to the European Commission, the term applies to any enterprise that fulfills both the following staff headcount measures and at least one of either the Turnover or Balance Sheet Total measures:

Company category	**Staff headcount**	**Turnover**	or	**Balance sheet total**
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Table1: European Commission conditional measures of SMEs

Approach

The method for developing this thesis was six-folded:

To begin with, what was done was to conduct an intensive literature review on the subject of EA and then specifically on the subject of EA for SMEs. This was done by using the following sources: EBSCO; Cambridge Journals; B-on; DART Europe; DOAJ; EconLit; EconPapers; Emerald; Google Scholar; JSTOR; NOVA Discovery; Nova SBE Working Paper Series; OALster; RCAAP; Scopus; SSRN; Taylor & Francis Online; Web of Science and Wiley Online Library.

The next step was to use the acquired knowledge and materials to try and develop Models for various purposes and needs, as a way to attempt to model various Views and Functions that the chosen type of SME is either required to have or is incentivized to develop.

The Departments whose functions were modeled were: Inventory Department; Production Department; Sales Department; Quality Control Department; Human Resources (HR Department); Customer Relationship Management (CRM) Department and Financial Department.

The next step was gathering variables to allow for segmentation of all companies, prior to contacting them, to make sure they were truly Web-reliant companies, meaning usage of the internet to expose themselves to potential customers was crucial. The specific questions can be found in the **Constraints** section of this work.

After selecting them, they were contacted via email.

The following step was to have two sets of meetings with the companies in order to validate the models that had been created and to see how much they fit into the reality of the companies and what was missing or that was too much.

The final step was to rework the models in accordance to the feedback, if such was deemed required.

Company Description

Out of all the 30 companies contacted, four of them, all Small Businesses, agreed to cooperate with the research. Three of them were companies focused on the sale of physical goods and products and the last was a company that sold services related to leisure.

In order to preserve the privacy and anonymity of the companies in question and to keep this thesis from being used in order to overly mimic their business model, the product companies will be referred to as companies X, Y and Z and the services company will be referred to as company A.

Company X focuses on selling medical and surgical equipment to hospitals and other clients. It is managed by someone in their 50s and without a formal management degree. It has also been in business for over a decade.

Company Y is dedicated to the sale of clothing and related items. The management is comprised only of young people with formal backgrounds in management and other areas. It was also founded in the 2010s.

Company Z focuses on the sale of vintages and spirits, as well as related accessories. It is currently managed by a combination of people in their twenties and people in their fifties. The younger management staff possesses formal backgrounds in management and other areas, but the qualifications of the older members could not be confirmed. The company has been in business for over two decades.

Company A rents customized vehicles for recreation purposes. The management is comprised only of young people with formal backgrounds in management and other areas. It was also founded in the 2010s.

Metamodel

A metamodel is the description of rules, frames, constraints and theories that the Model itself will follow. The metamodel in this document will identify the meaning attributed to the several representations in the Models created as well as additional information that has been found relevant for aiding in the comprehension of it. Refer to Appendix A for extra, more in-depth

information on what each representation is supposed to represent, as well as the connectors that link these representations.

As previously mentioned, the "Views" that were used exclusively the "Business View" and the "Application View". As such, only the concepts and representations relevant for those will be addressed.

Representation Name	**Usage In-Model**
Business Actor	Used to represent key entities necessary for the functioning of the business. These are usually the company in question, its departments, clients, suppliers and other business partners.
Business Function	Used to represent sets of responsibilities, that are met by both Business Roles and Business Processes, within Departments. Occasionally, they can also encompass more than one Department.
Business Role	Used to represent individuals with specific job descriptions and positions within the company, such as Managers and Workers.
Business Process	Used to represent a set of actions and behaviors that need to be done in order to ultimately produce a defined set of Products or Business Services (Open Group, 2016), which are crucial for the functioning of the business. It is possible for business processes to be made up of smaller business processes.
Business Event	Used to represent "something" which either triggers or interrupts a set of actions. The origin of which can come from either internal or external.
Business Location	Used to represent a physical location that is relevant for the model at hand.
Business Service	Used to represent a function or service that is generated by Business Processes, business functions or business Co-Operations and that fulfills a business need of a customer, be that customer an entity that belongs to the company or someone that is external to it (Open Group, 2016).
Business Co-operation	Used to represent temporary joint efforts between Business Roles or Business Processes that are required to bring what is contained in other representation(s) into fruition.
Business Interface	Used to represent communication channels that allow Business Actors and Business Roles to communicate with one another. These can vary, depending on whether the representations that are required to communicate exist within or outside the Company.
Business Object	Used to represent documents or tacit knowledge that are required by Business Roles or Processes in order to complete other Processes. They can also be created from modeled Business Processes.

Table 2- Business View Representations

Representation Name	Usage In-Model
Application Components	Used to represent specific parts of the software that execute specific functions, in order to supply the necessary data or non-physical services to the Business Roles and Business Processes (Open Group. 2016). They also act as repositories for pre-existing data files.
Application Functions	Used to describe the internal behavior roles of the Components in greater detail (Open Group. 2016). Their name will be directly related to the kind of Data that they access or the Services they produce.
Application Services	Used to illustrate the non-passive uses of the Application Functions and Application Co-operations. They represent actions that are automatically generated by the software systems. These mainly exist to represent alerts that are essential for the operations of the company or to automatically create new Data Objects, by merging or queering the company's Data.
Application Collaborations	Used to represent temporary joint efforts between two or more Application Components, that are required to bring what is contained in other representation(s) into fruition.
Application Interfaces	Used to represent software-based means of communication required for Data Objects or Application Services to move through.
Data Objects	Used to represent Software-based files that are either stored in the company's internal Application Components or taken from outside sources.

Table 3- Application View Representations

Representation Name	Usage In-Model
Grouping Relationship	This indicates that the representations "nested" inside it share some significant common relationship with one another.

Table 4- Additional Representations

List of Models Created

Below, all Models created can be found listed in tables. Each of them possesses a brief description of the processes they intend to represent and analyze, as well as any necessary noteworthy characteristics of that model, compared to the rest. Additionally, they are assigned to specific departments. Finally, the most relevant references that were used for their creation can also be found in these tables. In the event that any Models in particular lack references, this is due to them having been heavily, if not exclusively based on the tacit knowledge of the author of this work and should, therefore, be considered intellectual material exclusive to this work alone.

Models Exclusive to Product Companies

Company Department	Model Name and Description		Relevant References
Inventory Department		**Inventory Department**	
	Name	**Stock Replenishment Model**	
	Description	This model aims to describe the Business Processes required to deal with a situation of stock rupture or low stock confirmation, up until the point in time in which the stock returns to acceptable levels.	
	Name	**Product Delivery Model**	
	Description	This model aims to describe the Business Processes that occur from the moment a customer requests a product up until the time that they receive it. In this model, there exists the notion of "Delivery Batches". This term refers to different purchases from different customers being grouped together when handed to the supplier of transportation services, due to the customers residing in nearby areas.	
	Name	**Production Planning Model**	
	Description	This model aims to describe the Business Processes necessary to take the company's existing data and arrive at the ideal and most efficient production schedule for the duration of the next period. This model was created with the notion that the data required for it is unordered and therefore, not properly defined at the start of the process, in mind.	
	Name	**Effective Inventory Planning Model**	
	Description	This model aims to describe the Business Processes that are required for a company to understand how to make the best use of its inventory space, from a stock and cost perspective, as well as sourcing.	
Production Department		**Production Department**	
	Name	**Machine Maintenance Model**	
	Description	This model aims to describe the Business Processes required to implement optimal machine maintenance practices, from failure and parts replacement prediction to training employees to be able to conduct routine maintenance on a regular basis.	
	Name	**Quality Control Steps Definition Model**	(Oriental Semiconductors,2016)
	Description	This model aims to describe the Business Processes required for a company to define all necessary quality control steps and procedures for a new product or product line, whenever one is created.	
	Name	**Incoming Quality Control Model**	(Oriental Semiconductors, 2016)
	Description	This model aims to describe the Business Processes required to implement the previously prepared quality control procedures, in regards to product inputs required.	
	Name	**In-Process Quality Control Model**	

	Description	This model aims to describe the Business Processes required to implement the previously prepared quality control procedures, in regards to the preparation of the production process and all relevant quality control steps until the end of it for the first time.	(Oriental Semiconductors, 2016)
	Name	**Out-Going Quality Control Model**	(Oriental Semiconductors, 2016)
	Description	This model aims to describe the Business Processes required to implement the previously prepared quality control procedures, in regards to the execution of the production process after the first time and the quality control steps.	
Sales Department		**Sales Department**	
	Name	**Price Setting Model**	(Wasserman, 2010)
	Description	This model aims to describe the Business Processes required for a company to best define the price of any new products that it is introducing to the market.	
	Name	**Sales Goals Setting Model**	(Krishnan, 2016)
	Description	This model aims to describe the Business Processes required for a company to accurately set the revenue targets from sales for the next period.	
	Name	**Product Portfolio Management Model**	
	Description	This model aims to describe the Business Processes required for a company to evaluate the position of goods in the company's product portfolio, as well as to create new ones.	
Customer Relationships Department		**Customer Relationships Department**	
	Name	**Product Returns Model**	
	Description	This model aims to describe the Business Processes required to handle the return of a previously purchased from a customer, as well as to deliver a replacement product.	
	Name	**Lost Shipment Tracking Model**	
	Description	This model aims to describe the Business Processes required to deal with situations in which a customer complains about the lack of arrival of their order and to determine whether the shipment is delayed or lost.	
	Name	**Customer Refunds Model**	
	Description	This model aims to describe the Business Processes required for the execution of a monetary return from the company to the customer.	
	Name	**Informing Customers Model**	
	Description	This model aims to describe the Business Processes required for a company to properly address its customer base's doubts and questions regarding its businesses or services	

Table 4- List of models exclusive to Product Companies

Models Exclusive to Service Companies

Company Department	Model Name and Description		Relevant References
	Name	**Service Delivery Model**	
	Description	This model aims to describe the Business Processes that occur from the moment when a customer requests a service up until the time that they receive it.	
	Name	**Activities Planning Model**	
	Description	This model aims to describe the Business Processes necessary take the company's existing data and arrive at the ideal service delivery schedule for the duration of the next period.	
Quality Department		**Quality Department**	
	Name	**Service Cost Prediction Model**	
	Description	This model aims to describe, uniquely to the Application View, the functioning of customer-sided website functions, which allow the prospective customer to receive a prospective of what the service will cost them.	
	Name	**Service Quality Definition Model**	(Industry Development Fund, 2016)
	Description	This model aims to describe the Business Processes that are required in order to define the standards of quality for a new service, as well as the standards of all the different aspects that make up said service.	
	Name	**Input Quality Control Model**	(Oriental Semiconductors, 2016)
	Description	This model aims to describe the Business Processes that are required to evaluate the quality of the physical inputs of the service, whenever they find themselves in possession of the company.	
	Name	**Feedback Monitoring Model**	(Gupta et all,1991);+that other one
	Description	This model aims to describe the Business Processes necessary for a service to monitor all relevant sources of feedback from its customer base, as well as to measure the consequences of it.	
Sales Department		**Sales Department**	
	Name	**Intermediary Choosing Model**	(CrossPointe, 2016); (Chand)
	Description	This model aims to describe the Business Processes required for a company to choose the best possible intermediary, in order to reach customers that are currently out of reach.	
	Name	**Price Setting Model**	(Wasserman, 2016)
	Description	This model aims to describe the Business Processes required for a company to best define the price of any new services that it is introducing to the market.	
	Name	**Sales Goals Setting Model**	(Krishnan,2016)
	Description	This model aims to describe the Business Processes required for a company to accurately set the revenue targets from sales for the next period.	
	Name	**Service Portfolio Management Model**	

	Description	This model aims to describe the Business Processes for a company to evaluate the position of goods in the company's product portfolio, as well as to create new ones.	
Customer Relationships Department		**Customer Relationships Department**	
	Name	**Customer Refunds Model**	
	Description	This model aims to describe the Business Processes required for the execution of a monetary return from the company to the customer.	
	Name	**Informing Customers Model**	
	Description	This model aims to describe the Business Processes required for a company to properly address its customer base's doubts and questions regarding its businesses or services	

Table 5- List of models exclusive to Service Companies

Models Common to both Product and Service Companies

Company Department	Model Name and Description		Relevant References
Customer Relationships Department		**Customer Relationships Department**	
	Name	**Customer Policy Creation Model**	(Customer Service Manager 2016)
	Description	This model aims to describe the Business Processes required for the creation of a customer policy. A Customer Policy is a document that specifies all relevant aspects regarding any form of customer interaction between the company and the customer.	
Human Resources Department		**Human Resources Department**	
	Name	**Compensation Structure Model**	(Ojimba,2014) ;(Ashworthblack, 2016)
	Description	This model aims to describe the Business Processes required to establish a formal compensation structure within the company.	
	Name	**Position Description Creation Model**	
	Description	This model aims to describe the Business Processes required to establish formal descriptions for each position within the company, regarding responsibilities, remuneration, required qualifications, as well as other factors.	
	Name	**Employee Training Preparation Model**	(Training Today. 2016)
	Description	This model aims to describe the Business Processes required to prepare a formal training program for employees, adaptable to the type of skills and competences that may be required	
	Name	**Employee Training Execution Model**	

	Description	This model aims to describe the Business Processes required to execute the previously created training programs.	(Training Today. 2016)
	Name	**Employee Training Evaluation Model**	(Training Today. 2016)
	Description	This model aims to describe the Business Processes required to evaluate the previously created training programs.	
	Name	**Workplace Accident Report Creation Model**	(Levine,2015)
	Description	This model aims to describe the Business Processes required to file a formal report whenever a accident occurs in the workplace.	
	Name	**Exit Interviews Model**	(Hrcouncil, 2016)
	Description	This model aims to describe the Business Processes required to conduct a complete and extensive exit interview, whenever an employee resigns.	
	Name	**Employee Dismissal Model**	(Glickman and Bassuk, 2015); (The Muse, 2013)
	Description	This model aims to describe the Business Processes required to properly evaluate whether or not an employee deserves to be dismissed and how to go about it.	
Finance Department		**Finance Department**	
	Name	**Client Payment Inflows Model**	
	Description	This model aims to describe the Business Processes required to properly register and process a payment originating from a customer, for products or services rendered.	
	Name	**Supplier Payment Outflows Model**	
	Description	This model aims to describe the Business Processes required to properly register and process a payment done by the company to one of its suppliers.	
	Name	**Employee Salary Payment Outflows Model**	
	Description	This model aims to describe the Business Processes required to properly register and process a salary payment done by the company to its employees.	
	Name	**Aging Schedules Creation Model**	
	Description	This model aims to describe the Business Processes required to create both Macro and Micro Aging Schedules. An Aging Schedule is a document or file in which the debts of every customer are registered, as well as how delayed their payment is.	
	Name	**Payment Collection Model**	(Cunha, 2016) ;(Lesonsky,2014)
	Description	This model aims to describe the Business Processes required to deal with late paying customers and how to go about collecting those payments from them.	
	Name	**Budget Creation Model**	
	Description	This model aims to describe the Business Processes required to create operational budgets for the coming period, as well as training and payroll budgets.	
	Name	**Bank Reconciliation Model**	(Cunha, 2016); (Accounting Coach, 2016)
	Description	This model aims to describe the Business Processes required to properly conduct a bank reconciliation. A bank reconciliation is a mandatory monthly process that is required to properly synchronize a company's finances with the bank's image of the same.	

Table 6- List of models common to Product and Service Companies

List of Viewpoints Created

Departments Included	Models Included	Viewpoint Name	Viewpoint Description
All Departments	None	Organization Viewpoint	This Viewpoint aims to represent the existence of all departments within the company. A version of this Viewpoint exists for both company types
All Departments	All models	Actor Cooperation Viewpoint	This viewpoint aims to represent how and through which means each department communicates and interacts with each other, as well as with its clients, suppliers and other business partners. A version of this Viewpoint exists for both company types
All Departments	All models	Business Function Viewpoint	This viewpoint aims to identify all the existent business functions in the company and in each department and illustrate how and through which means these interact with each other and with its clients, suppliers and other business partners. A version of this Viewpoint exists for both company types.
Finance Department	Aging Schedules Creation Model; Payment Collection Model; Bank Reconciliation Model	Business Process Co-operation Viewpoint 1	This Viewpoint aims to identify how these three individual business processes interact and complement one another, describing as a coherent whole, the necessary procedures for a company to identify a late paying customer, to request payment from them and finally, notify the bank of the arrival of the missing payment, if it comes in after the emission of the monthly bank statement. This Viewpoint is applicable to both company types.
Sales Department	Price Setting Model; Sales Goals Setting Model	Business Process Co-operation Viewpoint 2	This Viewpoint aims to identify how these two individual business processes interact and complement one another, describing how the act of deciding on a price for a product or service can significantly contribute to the process of setting sales goals. A version of this Viewpoint exists for both company types.
Product Design Department; Production Department	Product Portfolio Management Model; Quality Control Steps Definition Model	Business Process Co-operation Viewpoint 3	This Viewpoint aims to identify how these two individual business processes interact and complement one another, illustrating how the new product/service designing aspect of portfolio management relates to the production of said products or the realization of said

			services and the creation of quality controls for the production of the same product or service. A version of this Viewpoint exists for both company types.
Inventory Management Department; Finance Department	Stock Replenishment Model; Product Delivery Model; Client Payment Inflows Model	Business Process Co-operation Viewpoint 4	This Viewpoint aims to identify how these three individual business processes interact and complement one another, illustrating how the company goes about understanding that they currently do not have the stock to meet the client's demand, replenishing said stock, meeting the demand and delivering the product to the customer and finally, receiving payment from them. This is because of the fact that Service companies also require some form of Inventory, when their services require some physical component that is sold to the client.
Inventory Management Department; Finance Department	Stock Replenishment Model; Supplier Payment Outflows Model	Business Process Co-operation Viewpoint 5	This Viewpoint aims to identify how these two individual business processes interact with one another, illustrating how the company goes about understanding that they currently do not have the stock to meet the client's demand, replenishing said stock and paying their suppliers.
Human Resources Department	Employee Training Preparation Model; Employee Training Execution Model; Employee Training Evaluation Model	Business Process Co-operation Viewpoint 6	This Viewpoint aims to chronologically link the models that comprise the different parts of employee training. This Viewpoint is applicable to both company types.
Quality Department; Sales Department; Service Design Model	Feedback Monitoring Model; Price Setting Model; Service Portfolio Management Model	Business Process Co-operation Viewpoint 7	This Viewpoint aims to identify how these three individual business processes interact and complement one another, describing as a coherent whole, the necessary procedures for a company to gather and structure the feedback they receive from their customer base, how the brand image of the company affects service price and how this price affects the decisions made in regards to the service when the portfolio is revised.
All Departments	All models	Layered Viewpoint	This Viewpoint differs from the previously listed models. The Layered Viewpoint exists to illustrate how other Views interact with and make the Business View representations possible. As a result, there exists a Layered Viewpoint for each individual model in each department. The exception to this are Service Company Models which are very similar, yet less complex than their Product counterparts. The Layered Viewpoint Assigns Groups to each type of representation and organizes them vertically, by overall order of importance. In the event that a Group for a certain model does

			not possess any representations, that indicates that those do not exist in that particular model.

Table 7- List of modeled Viewpoints

Company Feedback on the Models

The feedback revealed several things regarding the fit of the models for each individual company and for the size of the company as a whole. The feedback is considered an integral part of this thesis, as it not only provides proof of the field work developed, but is also of interest to the target audience of the same, which are small Portuguese companies or individuals that are interested in creating their own businesses. Due to the generalistic nature of the models developed, the feedback is considered a source of additional in-depth and market-specific information. This is useful for companies whose markets or businesses models are similar enough to the four companies evaluated, since it can assist them in understanding if the models possess representations or processes that are too complex and therefore, too superfluous for their nature as small businesses. Moreover, even the revised, post-feedback models possess some representations that may not be required for some companies and were kept in the models, due to at least one of the companies requiring it in their operational reality, or because the representation was deemed to be valid for companies of a similar scale, but in different markets. As such, they should be read alongside the feedback, in order for a company to determine whether they required some representations or not.

Refer to Appendix B for the Feedback. Note that this is not a word per word redaction of the meetings, so as to protect the privacy of the companies that cooperated with this thesis, but is rather a list of the misalignments between the models and the operational reality of the companies, as well as justifications for why that is the case.

For the final, post-Feedback revised Models, please refer to Appendix C and for the Viewpoints previously listed, Appendix D. Note that some models found in Appendix C will not be found there. They are better identified in the conclusions below, but them not being shown there is derived from their excessive detail and complexity, compared to the operational reality of the companies interviewed. Refer to Appendix E for these models, which require more developed organizations to be tested.

Constraints

There were several constraints in regards to the model validation when developing this thesis.

To begin with the questions that were required to segment the potential companies to contact, which count as a form of constraint to the work itself:

1- Are they a for-profit organization?
2- To they illustrate their goods or services using an online platform?
3- Are they selling a service that is very technical in regards to the IT aspect of it?
4- Is the payment for the goods or services handled on the basis of a subscription or handled per individual purchase?
5- Are the company's operations the kind that can be significantly affected by the forces of supply and demand and the ratio between the two?

Additionally, it is worth noting certain aspects that were of focus in the work itself, limiting its academic scope. The Views that were modeled were the Business View and the Application View. Due to its more technical nature from an IT standpoint and the fact that it is not something that would be easy to understand for most managers or entrepreneurs, nor easily translated into practical utility, the Infrastructure View was not modeled.

The Viewpoints that were modeled were all of those that were deemed relevant for the different possible stakeholders and that did not include the Infrastructure View as a component: Organization Viewpoint; Actor Co-operation Viewpoint; Business Function Viewpoint ; Business Process Co-operation Viewpoint; and Layered Viewpoint.

In regards to the relevance of Viewpoints, there were some that were not modeled because, while they did not contain the Infrastructure View, the information and the relationships that they aim to illustrate were already represented in other, more comprehensive Viewpoints, or they were too company-specific for the generalistic nature of the models.

Finally, there were practical constraints on the part of the companies. The unwillingness or unavailability of Portuguese SMEs to cooperate with the research, the fact that it had to be developed and validated during the Autumn and Winter seasons, making it a busy time for companies and therefore, allowing for less free time on their part to collaborate with the research and finally, not being possible to acquire the cooperation of Medium Enterprises in specific. All three constraints came together in the end to make it difficult or impossible to validate models of a higher order of complexity.

Conclusions

Regarding the conclusions that could be drawn by the Feedback and on the fit with the models themselves, there were several aspects that could be observed.

To begin with, there were several models, particularly belonging to the HR, CRM and Finance Departments, that were seen as too complex for the operational reality companies. Because of this, they were deemed as being either irrelevant for them or had to be greatly simplified to fit with their reality. From this, it can be inferred that the original version of these models can be put to use in

larger companies, possibly starting at the Medium Enterprise level, as the companies admitted that, while they do not require such complex models at the moment, they see it as something that they will most likely require in the future.

In particular, the Employee Dismissal Model was noted as being unnecessary by two of the companies. This is because they are young companies that are currently growing and have therefore, never needed to dismiss any employees. The same could be said of the Exit Interview Model, with none of the companies having ever needed to conduct them.

Regarding the Models that revolve around employee training, one of the companies stated that they have never given any to their employees. Three others stated that the models were far too complex and did not properly reflect their operational reality as a result. These models were heavily simplified post-feedback.

The Product Returns and Customer Refunds Models were also deemed as superfluous in their entirety by one and two companies respectively and the Lost Shipment Tracking Model did not seem to be relevant for most of the companies due to the quality of the transportation services that they outsource.

While on the topic of outsourcing, the models belonging to the Financial Department were harder to verify, due to a great majority of the tasks being outsourced by these companies. The same could be said of the Workplace Accident Report Creation Model.

Moving now to the Compensation Structure Model, it was only possible to obtain feedback on it from one of the companies. While it was verified that the model contained unnecessary representations and that none of the companies possessed a formally defined compensation structure, it was confirmed that at least some of the steps required for it are executed by the

companies, when deciding on how much they should pay their employees. Overall, it seems this model is not well-suited for Small Businesses, but is most likely well aligned with Medium Enterprises, due to their more organized structure, as noted by one of the company representatives, due to his experience in working in larger organizations.

Finally, regarding particular deviations in-model from the companies' operational realities, there are two things worth mentioning. The first is that there were a number of Application Services that were originally modeled as activities that were automatically conducted by the companies' systems that turned out to be handled by hand. As a result, these can be considered as valid for larger companies, with more automated processes, but not for small companies, where in which such actions are still conducted by employees. The second is that there were some Business and Data Objects that, while the companies are very much aware of the content that would go into them, they do not yet exist as formal documents and as a result, they are considered tacit knowledge. The most relevant of these are the "Customer Policy", "Company Benefits" and "Storage Methods" Objects.

To sum up, the Product Companies analyzed displayed well established notion, regarding the formalism and the complexity of most Processes related to the Inventory and the Production Departments, which are, particular at this stage in their lives, their core competencies. Likewise, the Service Company also seemed to strongly adhere to models based on the researched best practices, in regards to the Quality Department and the handling of their daily operations.

In Regards to the Sales and CRM Departments, there seemed to be varying degrees of compliance with the models, in both company types, but they still showed an acceptable level of compliance, with the exception of Company Z, which seemed to significantly lack in compliant CRM Department structure.

Finally, the outsourcing of several functions from the HR and Finance Department made it difficult to evaluate compliance in these Departments. Company Y in particular communicated that they handled these procedures themselves, but they could not be reached for verification of them. However, this, together with Company A stating that they will soon stop outsourcing these functions seems to imply that even these younger companies are moving in the direction of increasing the complexity of their organization and EA as a consequence.

As such, it can be understood that the Small Businesses evaluated during this work possess a level of EA close to the academic best practices.

5.4 Future Work

Future empirical research should be done, using the ideas from this thesis as a basis.

A longer term study could be devised, so as to make sure that Medium Enterprises can also be contacted well in advance and meetings can be formally scheduled. Additionally, the post-feedback models created in this work should be compared with the operational reality of both Small and Medium Portuguese Enterprises, so as to understand to what degree the companies involved in this work are beyond the norm in regards to EA, which effectively solves the problem of biased results brought about by a small sample of companies. Finally, the post-feedback models can also be compared to companies of similar scale abroad, so as to understand how Small Portuguese Businesses compare to their foreign counterparts

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